



U.S. DEPARTMENT OF
ENERGY

Engineering & Technology Update

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Office of Engineering and Technology

Site Specific Advisory Board Meeting

Savannah River Site – Augusta, GA

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Introduction

- **Engineering and Technology Mission**
- **Strategic Planning and Management Initiatives**
- **Engineering Initiatives**
 - **Technology Readiness Assessment**
 - **External Technical Reviews**
- **Leverage Research and Development from Public and Private Sector**
- **Technology Development**
- **Energy Park Initiative**



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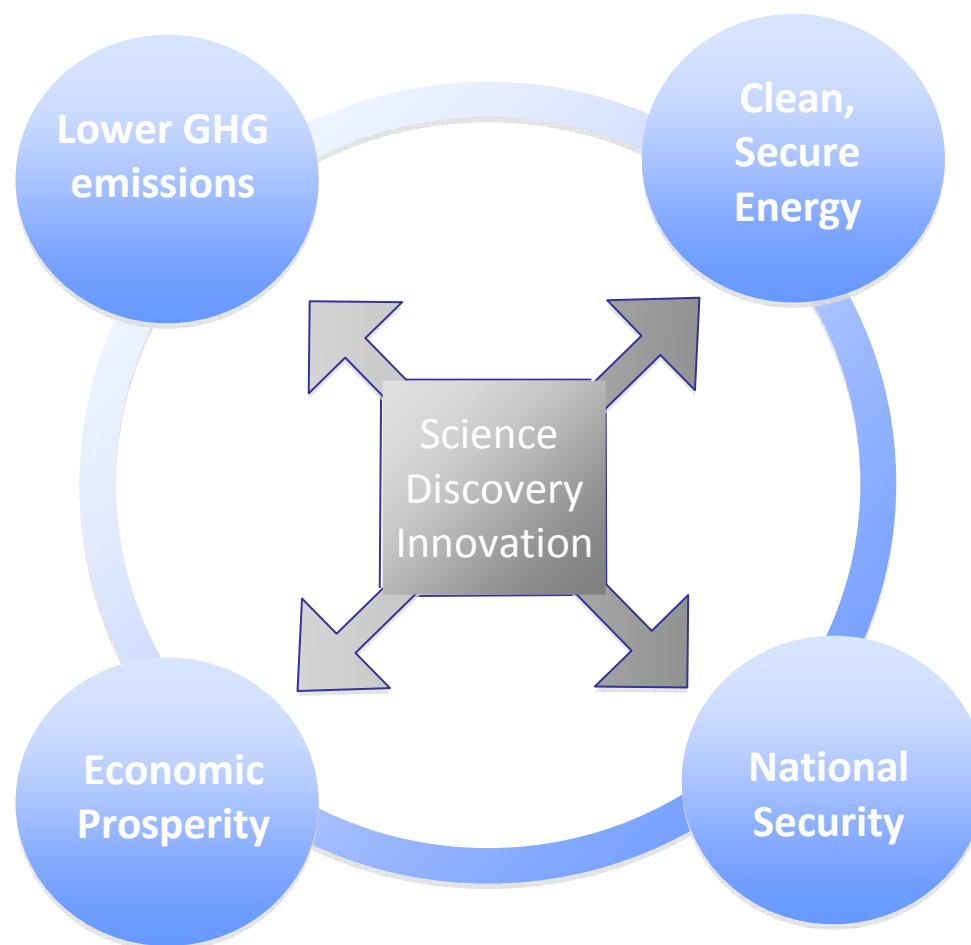
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Strategic Framework: *Science & Discovery at the Core*



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Engineering and Technology

➤ **Mission**

- To identify vulnerabilities and to reduce the technical risk and uncertainty in EM projects

➤ **Vision**

- Engineering and technology initiative will provide the engineering foundation, technical assistance, new approaches, and new technologies that contribute to significant reductions in risk (technical, environmental, safety, and health), cost, and schedule for completion of the EM mission.



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Strategic Planning for Engineering and Technology Program Activities

- **Strategic Planning Approach**
 - Implement Roadmap Initiatives
 - Select Critical, High-Risk, High-Payoff Projects
 - Conduct Technical Workshops and Exchanges
 - Complete External Technical Reviews
 - Review Risk Management Plans
 - Complete Technology Readiness Assessments
- **Collaboration with National Laboratories, Private Sector, and Universities for innovative technologies and technical exchanges**
- **Work with Federal Project Directors**



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Engineering and Technology FY2009 Management Initiatives

- **Best-in-Class Program**
- **Technology Readiness Assessment Policy and Guidance**
- **External Technical Review Guidance**
- **Secretary's Transformational Energy Action Management (TEAM) Initiative**
- **Real Property Management Process**

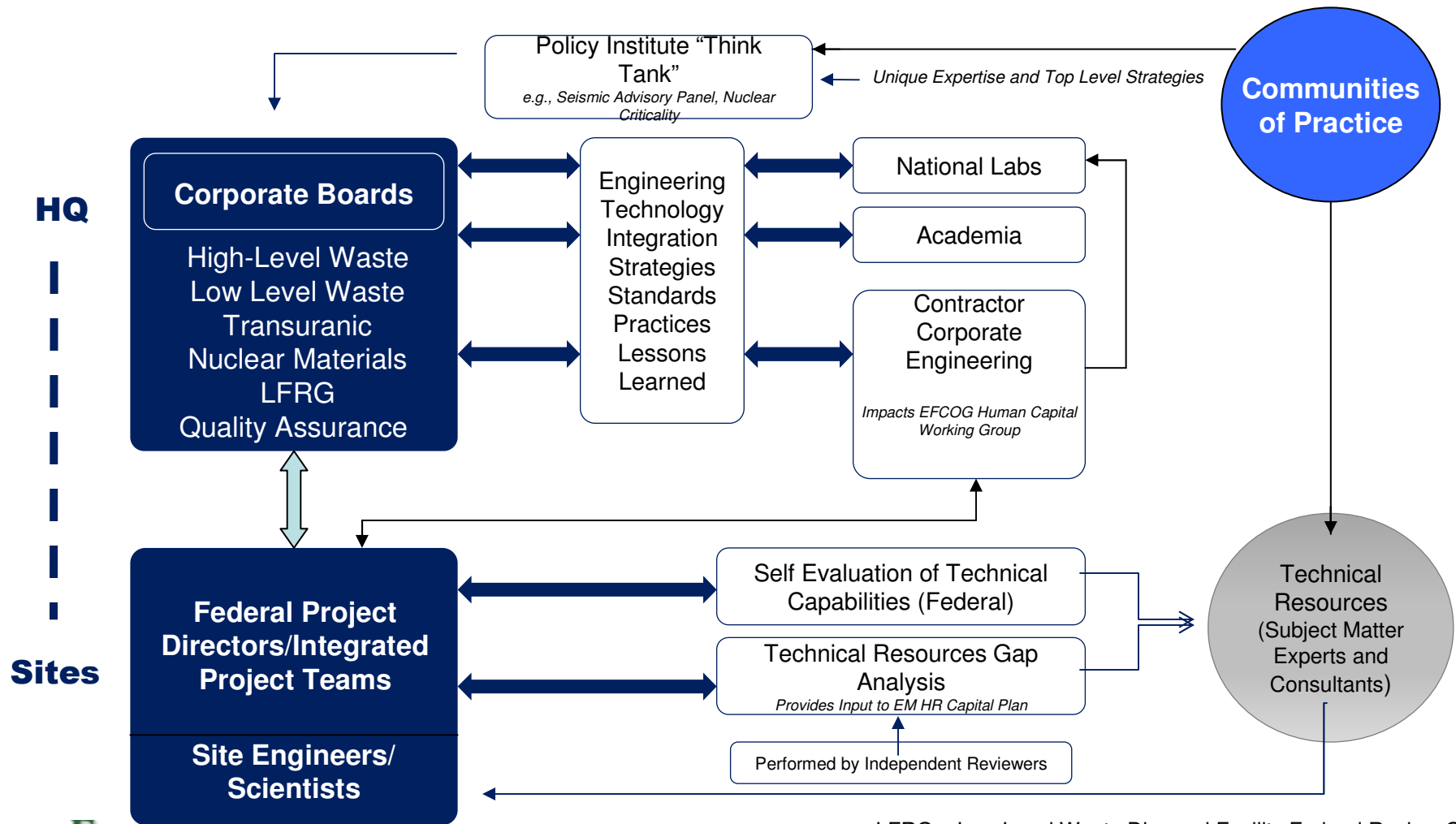


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Striving for EM Program Engineering and Technology Excellence



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LFRG – Low Level Waste Disposal Facility Federal Review Group
EFCOG – Energy Facilities Contractors Group

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NAS Advice on DOE's Cleanup Technology Roadmap: Gaps and Bridges

National Academies Interim Report Observations – Feb. 2008

- **Complexity and enormity of cleanup task require . . . significant, on-going R&D program.**
- **EM Roadmap can be an important tool for guiding R&D investments.**
- **National Laboratories at each of the four major sites have special capabilities that are needed to address EM's long-term needs.**



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NAS Advice on DOE's Cleanup Technology Roadmap: Conclusions

- At the beginning of the study the NAS Committee understood that the Roadmap would be a 'living' document to help plan, justify, and increase the effectiveness of EM's R&D program in support of its site cleanup mission.
- The Committee found that the Roadmap can be an important tool for enhancing EM's R&D efforts and has recommended detailed improvements and periodic updates of the Roadmap.



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Technology Readiness Assessments

- **A useful project management tool to support design/construction project management decisions, reduce technical risk – and thereby – limit costs and schedule overruns**
- **A consistent, systematic and structured process to evaluate and communicate the status of technology development**
- **An emerging standard for Federal Projects**
 - **Originally developed by NASA**
 - **Congressionally mandated for DoD**
 - **Recommended for DOE use by GAO (GAO-07-336)**
- **International use – U. K. Nuclear Decommissioning Authority, Australian Defense Department**



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External Technical Reviews

Improved reliance on external technical reviews (ETRs)

- **Review conducted by subject matter experts who are independent of the project**
- **Provide information relevant to assessing technical risk for the project**

Results are used to:

- **Develop strategies for reducing identified technical risks**
- **Provide technical analysis to support critical project decisions**



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Technical Risk Rating Indicators

➤ “Stoplight” Indicators:



Project technical risk(s) require heightened attention and may require Acquisition Executive decisions on direction or resources.



Project technical risk(s) require additional focus and may require Acquisition Executive decisions on direction or resources.



Project technical risk(s) have concerns in several areas and may require additional focus by the Integrated Project Team.



Project technical risk(s) are manageable. Minor concern in selected areas, but additional focus not required.



Project technical risk(s) are manageable as planned.



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Technology Development and Deployment

- **Much progress made in Environmental Management cleanup mission, e.g., new technical approaches were instrumental in the completions at Fernald and Rocky Flats (e.g., silos waste retrieval and processing and silos grouting at Fernald and chemical decontamination of glove boxes and tanks at Rocky Flats); more expected over next few years.**
- **Major uncertainties/risks across the DOE complex must be addressed through innovative technologies and approaches.**
- **Technologies have been inserted to reduce risk through accelerated schedules, cost savings, reduction in worker risk, and solving intractable problems.**
- **Solutions have made a difference in waste processing, soils and groundwater treatment, and deactivation and decommissioning.**



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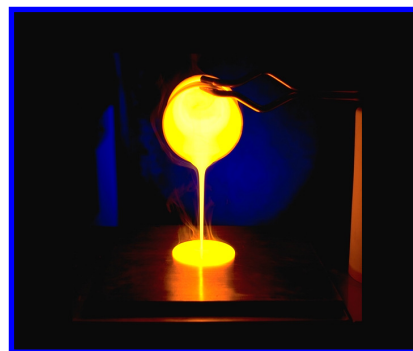
New Technologies and Processes Benefit EM Cleanup Mission



New decontamination approach at Rocky Flats significantly minimized waste generation and ultimately enabled site closure



Robotic crawler reduced worker safety risk at Hanford site



Improved glass formulation saved millions of dollars at Savannah River's Defense Waste Processing Facility



Alternatives to costly Pump and Treat technology used to clean up contaminated soil and groundwater

New technology deployment resulted in significant risk reduction and cost avoidance.

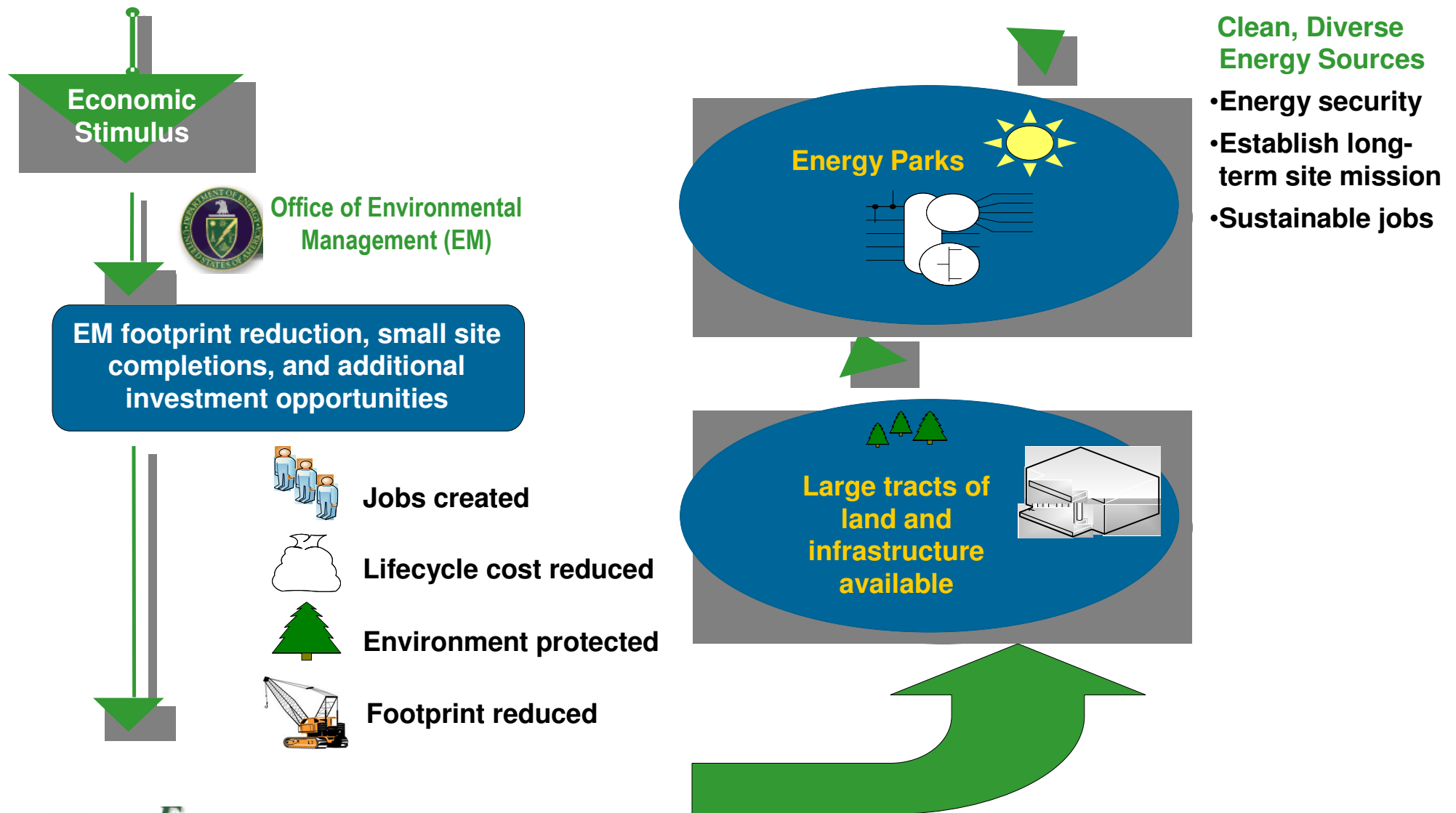


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Footprint Reduction



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Energy Parks Initiative: A bold and innovative concept

- . . . to leverage assets and create opportunity to enable rapid development of large-scale energy-related facilities.**
- . . . particularly those with significant potential of sustained progress towards energy independence, regional economy, national security, environmental sustainability, and other national concerns.**



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Energy Parks Initiative: Summary

- **A teaming of DOE, industry, and regional stakeholders, to enable rapid development of certain large-scale facilities at specific sites.**
- **DOE generates opportunity by designating valuable assets (including land), requesting expressions of interest, and negotiating to maximize the value and impact of opportunity.**



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Energy Parks Initiative: Why EM?

- **Facilitates EM mission execution**
 - **Transition to beneficial use**
 - **Engages stakeholders as partners**
 - **Leverages liabilities into opportunity**
 - **Supports “industrial use” standards**
 - **Reduces “EM footprint”**
 - **Averts life-cycle costs**
- **Attractive assets help meet national goals**
- **Increases taxpayer return-on-investment (ROI)**



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Energy Parks Initiative: Kind of Assets

- ✓ **Infrastructure** (roads, buildings, equipment, utilities, barge & rail access, transmission systems, and specialty features and capability)
- ✓ **Natural Resources** (land, water, and renewable energy)
- ✓ **Institutional Controls** (clear land title, physical control, water rights, NPDES and other permits, buffer area, environmental & seismic characterization, and security)
- ✓ **Human and Economic Capital** (knowledge of regulatory environment, highly trained workforce, transition to succeeding missions, and return of valuable assets to the local tax base)
- ✓ **Diversity, Size, and Remoteness** (allows consideration of many uses, and protection of critical infrastructure)
- ✓ **Applied Tools** (technology, loan guarantees, purchasing power)



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Energy Parks Initiative: Technology

Options include conventional & advanced energy technologies, such as:

- **Renewable energy: solar, wind, biomass, geothermal**
- **Fossil fuels: clean coal, gas turbines**
- **Electricity generation, transmission, & distribution**
- **Hydrogen generation**
- **Emission controls, carbon sequestration**
- **Specialty manufacturing**
- **Nuclear: power, fuel cycle, waste management**



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Related Activity: Supports Energy Parks Initiative

... from “**greening**” of energy supply to teaming with community reuse organizations & industry

- **Hanford:** shares infrastructure with nuclear utility; 71 acres transferred for development
- **Savannah River:** working on leasing 2,500 acres for electric production; large-scale demonstration of new energy technologies and manufacturing of energy generation equipment
- **Oak Ridge:** private-sector business and industrial park; transferred 50 acres and much site infrastructure
- **WIPP:** RFI for 16 square miles of solar resources
- **Mound and Fernald:** ongoing site conversion



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Challenges

- **Provide solutions to reduce technical uncertainty, especially for first of a kind technologies.**
- **Improve engineering and scientific capabilities.**
- **Develop policy, strategies, and guidance for facility management and land redevelopment and for improvement of energy efficiency and conservation.**
- **Determine the investment level needed by EM to address the engineering and technology challenges of the future.**
- **Determine options for reuse of sites as the EM footprint is reduced**



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Conclusions

- Engineering tools such as Technology Readiness Assessments and External Technical Reviews have been proven useful in providing significant input for critical project management decisions. Technology Maturity Plans are key to reducing project risk.
- Roadmap identifies strategies and needs to reduce risks and technical uncertainty to improve technologies and processes at EM sites.
- Project Risk Management Plans should be used to help resolve technical risks and uncertainties. Technical Risk Rating Tool helps project managers assess existing technical Risk and makes the assessment process more transparent.
- Establishment of communities of practice within EM and its stakeholders to foster the exchange of technical and scientific information and solutions will improve communication that is needed to ensure project success.
- Energy Parks are a beneficial reuse of sites as the EM footprint is reduced.



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BACK UP SLIDES



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NAS Advice on DOE's Cleanup Technology Roadmap: Principal Science and Technology Gaps

Waste Processing:

- 1. Substantial amounts of waste may be left in tanks after their cleanout—especially those with obstructions or associate piping. (High Priority)**
- 2. Low-activity streams from tank waste processing could contain substantial amounts of radionuclides. (Medium Priority)**
- 3. New facility designs, processes usually rely on pilot-scale testing with simulated rather than actual wastes. (Medium Priority)**
- 4. Increased vitrification capacity may be needed to meet schedule requirements of EM's HLW programs. (High Priority)**
- 5. The baseline tank waste vitrification process significantly increases the volume of HLW to be disposed of. (Medium Priority)**
- 6. A variety of wastes and nuclear materials do not yet have a disposition path. (Low Priority)**



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NAS Advice on DOE's Cleanup Technology Roadmap: Principal Science and Technology Gaps

Groundwater and Soil Remediation:

- 1. The behavior of contaminants in the subsurface is poorly understood. (High Priority)**
- 2. Site and contaminant source characteristics may limit the usefulness of EM's baseline subsurface remediation technologies. (Medium Priority)**
- 3. The long-term performance of trench caps, liners, and reactive barriers cannot be assessed with current knowledge. (Medium Priority)**
- 4. The long-term ability of cementitious materials to isolate wastes is not demonstrated. (High Priority)**



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NAS Advice on DOE's Cleanup Technology Roadmap: Principal Science and Technology Gaps

Facility Deactivation and Decommissioning (D&D):

- 1. D&D work relies on manual labor for facility characterization, equipment removal, and dismantlement. (High Priority)**
- 2. Personal protective equipment tends to be heavy, hot, and limits movement of workers. (Low Priority)**
- 3. Removing contamination from building walls, other surfaces can be slow and ineffective. (Medium Priority)**



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NAS Advice on DOE's Cleanup Technology Roadmap: Findings

- **FINDING:** The EM Technology Roadmap is an important and much needed tool for guiding DOE headquarters investments in longer-term R&D to support efficient and safe cleanup.
- **FINDING:** The current Roadmap describes technical risks in the EM site cleanup program and R&D initiatives to mitigate these risks. However, it does not connect these initiatives to major milestones in the EM cleanup program.
- **FINDING:** EM is the DOE office designated to clean up the nuclear materials production sites of the Cold War. Cleaning up these legacy sites nevertheless remains a responsibility for all of DOE and the Nation. EM cannot complete its mission without the active cooperation of other DOE offices and Federal agencies. The Roadmap can be improved by specifying opportunities for cooperative work with the National Laboratories and other DOE and Federal agencies.
- **FINDING:** The scientific and technical state-of-the-art will evolve during the next 30 years of the EM site cleanup program, as will public expectations for the cleanup goals. A robust EM science, engineering, and technology program will be required to keep up with these evolutions, to provide up-to-date bases for EM's cleanup decisions, and to maintain a skilled workforce.
- **FINDING:** The unique chemical, physical, and radiological properties of waste and contamination at the EM cleanup sites, and the unique subsurface characteristics of the sites themselves require special capabilities of the sites and their associated National Laboratories to sustain long-term R&D for EM's 30-year cleanup program. These special capabilities include qualified, experienced personnel and facilities for radiochemical, engineering, and field experiments. It is Congress' and DOE's responsibility to maintain the National Laboratories' capabilities, not only for cutting-edge scientific research, but also for research applied to national problems such as DOE's Cold War legacy cleanup.



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Edible Oil Treatment Leads to Enhanced Attenuation for Chlorinated Solvents

Need

- There are two fundamental challenges in reaching final closure for many DOE sites with contaminated soils and groundwater
 - Transitioning from costly source treatments to passive (green) treatments and to an acceptable end state
 - Developing regulatory support and acceptance to implement attenuation based remedies

Solution

- Demonstrate full scale test of enhanced attenuation remedy utilizing edible oil at Savannah River Site's T-Area

Results

- Edible oils can reduce contaminant concentrations in two ways: stimulating microbiological degradation processes and reducing contaminant mobility by physical sequestration
- Developing guidance with state and federal regulators for implementing attenuation based remedies within regulatory frameworks

Impact

- Technical developments enable transition from active, energy-intensive treatments to “green” treatments, minimizing our energy footprint on a national scale, while also saving money
- Publicly available training is resulting in technical advancements in the public/private sectors.



Researchers are hopeful that an enhanced attenuation approach will lead to effective groundwater cleanup with reduced energy use and impact to the environment



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Low – Temperature Caustic Leaching

Need

- The mass of Sludge in the SRS High-level waste (HLW) tanks is currently estimated to fill ~ 7,900 canisters when treated, which is more than previously estimated and likely will impact the Site Treatment Plan commitment to treat all HLW by 2028

Solution

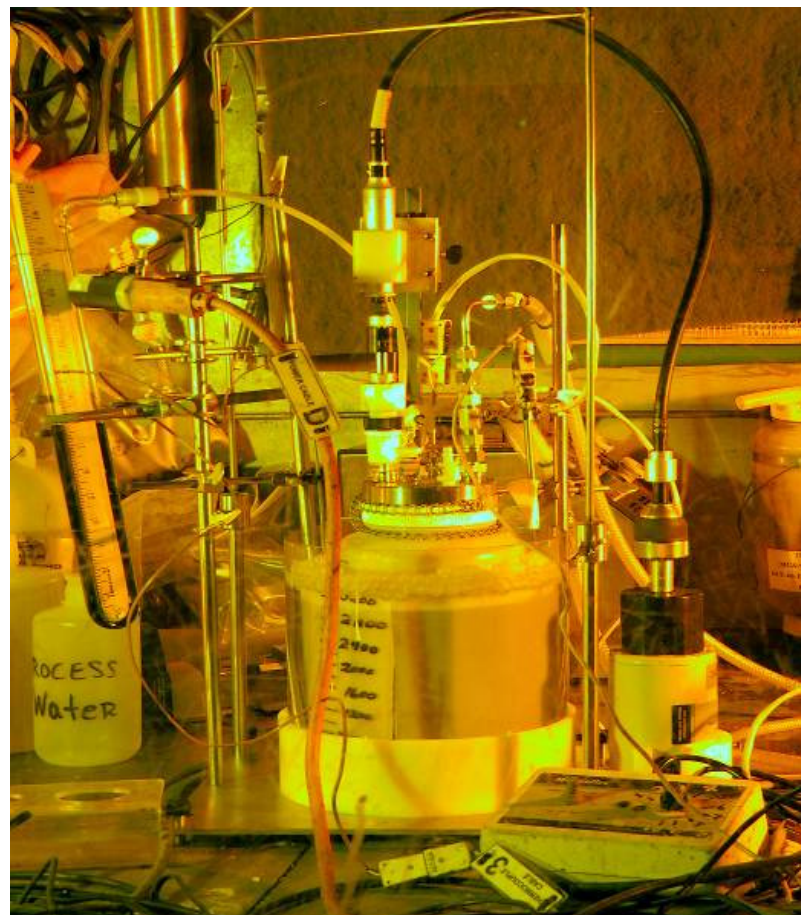
- In-tank, low-temperature caustic leaching to remove the aluminum in the sludge could significantly reduce the volume of waste required for vitrification

Results

- Low-temperature caustic leaching was recently demonstrated at full scale in Tank 51 at SRS
 - 65% of the insoluble aluminum was removed
 - No new equipment was required and dissolution was complete after 80 days
 - The aluminum-rich decant stream is staged for feed to the Salt Waste Processing Facility

Impact

- The aluminum removed reduced the sludge volume by the equivalent of 100 canisters, reducing the total life-cycle cost of the SRS HLW mission by an estimated \$100 million
- This process is expected to reduce sludge mass by the equivalent of 900 canisters with a \$900 million life-cycle cost reduction



Caustic Leach Test System



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D&D Toolbox

Need

- 207 facilities at the Oak Ridge Reservation and hundreds of facilities at other DOE sites awaiting D&D were erected in the mid 1940s and early 1950s to support the Manhattan Project and Cold War missions and are now structurally deteriorated and unsafe for workers to access for surveillance and maintenance and D&D

Solution

- A systems approach, being used for highly contaminated, deteriorated structures that may be unsafe for prolonged worker access will deliver a “D&D Tool Box” with validated performance data on applicable D&D technologies that can be used on a wide variety of facilities and structures

Results

- The “D&D Tool Box” consists of characterization, decontamination, and demolition technologies, including robotic systems and platforms that will provide alternative approaches to D&D

Impact

- The “D&D Tool Box” will provide reduced risk to workers, site personnel, and the environment while accelerating D&D and saving money
- The technical approaches will be applicable across the DOE Complex



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